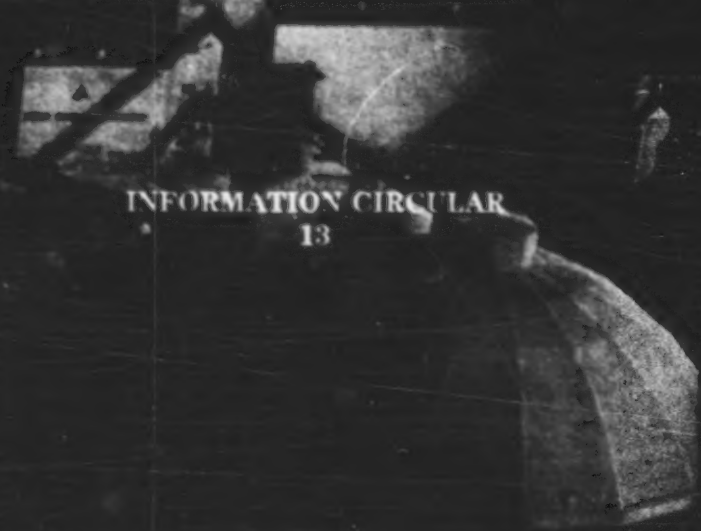
LIMESTONE and DOLOMITE in NOVA SCOTIA

by P. Luke and R.H. MacDonald



INFORMATION CIRCULAR 13

88-04157/

Cover Photo: Lafarge Canada Inc., cement plant, Brookfield, Colchester County (courtesy of D. Clark).

LIMESTONE and DOLOMITE in NOVA SCOTIA

by P. Luke
and
R.H. MacDonald

Information Circular
13

Nova Scotia Department
of Mines and Energy
Halifax, Nova Scotia
1988

LIMESTONE AND DOLOMITE

Introduction

Limestone, and to a lesser degree dolomite, are among those mineral commodities that play a vital role in retaining our present day lifestyle but never seem to receive the recognition deserved. They are essential, either directly or indirectly, in all of today's construction, chemical and manufacturing industries. Limestone is one of the earth's most common mineral commodities and is presently mined or quarried in all but one of the American States and in six Canadian Provinces. Its documented use dates back to the Egyptian pyramids when it was used both as a dimension stone and a bonding agent. The Greek and Roman Empires recognized limestone's unique chemical properties and used it as a bleaching agent, an ingredient in special medicinal tonics, and as a soil sweetener in agriculture.

Plate 1. Marble Mountain limestone operation, circa 1920.

MINERALOGY

Limestones can be classified either as chemical precipitates or as an organic sedimentary rock. Since sea water is nearly saturated with calcium carbonate, slight changes in water temperature or chemical composition can bring about the precipitation of calcite out of solution. The

more prevalent form of limestone is as an organic sedimentary rock. These are comprised of the fossil remains of sea organisms or of calcareous shell material that has been reworked and consolidated.

Limestone in its purest form is known as calcite with a chemical composition of $CaCO_3$ (calcium carbonate) made up of 56.0 per cent CaO (lime) and 44 per cent CO_2 (carbon dioxide). Limestone often contains small quantities of impurities such as magnesium, iron, zinc, manganese and lead. Dolomite is a magnesium limestone or a carbonate of calcium and magnesium $CaMg(CO_3)_2$. Pure dolomite contains 47.8 per cent CO_2 (carbon dioxide), 30.4 per cent CaO (lime), and 21.8 per cent MgO (magnesia). Iron and manganese carbonates are also sometimes present.

There are many varieties of limestone. It can be coarse to very fine-grained in texture, hard to soft in compaction. The colour can vary from pure white, to grey, buff, yellow, red, green, brown, blue to black and may be laminated. Limestone may be metamorphosed to a grade where it readily accepts a good polish suitable for dimension stone and is referred to as marble.

LIMESTONE DEPOSITS

Limestone may be represented to some extent in many geological systems in Nova Scotia, however, it is only in the Precambrian George River Group and the Carboniferous Windsor Group that it attains sufficient extent, thickness, and grade to be considered economically significant.

The older Precambrian George River Group limestones and dolomites tend to be more crystalline, altered, and larger than the Windsor Group deposits with some deposits containing reserves in excess of 300 million t. These deposits are located only on Cape Breton Island. A few have been exploited in the past, mainly for use in steel making at Sydney. These meta-sedimentary rocks are enfolded with granitic rocks of different ages and make up much of the Highlands of Cape Breton Island. Bands of quartzites, slates, and schists are associated with these carbonates and a variety of dykes and sills are known to be injected throughout them. These meta-sedimentary rocks of the George River Group form part of the Coxheath Hills, Boisdale Hills, Creignish Hills and North Mountain. Minor occurrences are

found on St. Anns Mountain and at a few isolated locations in Inverness and Victoria Counties.

The George River Group limestones and dolomites, and associated sedimentary sequences, occur in long, usually steeply dipping bands along the flanks of the granitic hills. Some of these bands are in excess of 150 m thick as indicated by diamond-drill holes at Glencoe, Inverness County (MacNeil, 1976).

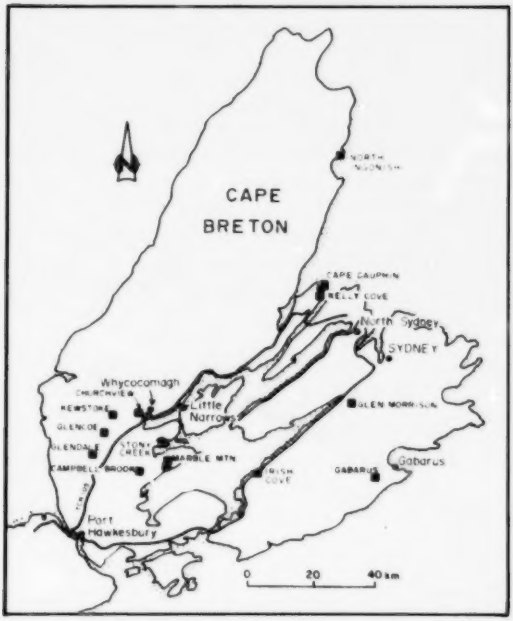


Figure 1. Major limestone and dolomite deposits of Cape Breton Island.

The composition of these carbonates ranges from high calcium content to low calcium, high magnesium content and commonly varies within one deposit unlike the younger Windsor Group carbonate deposits which usually have a consistent composition throughout. Associated with the George River carbonates are impurities of silica, iron, and serpentine. In areas of high temperature alteration, brucite, wollastonite and minor magnetite, chalcopyrite, pyrite and sphalerite may occur.

The Early Carboniferous strata of the Windsor Group contain limestones of every variety

from high calcium limestones to dolomite. These marine deposited sedimentary rocks make up over 5000 km^2 of the surface of Nova Scotia and rest unconformably, in most areas, over sediments of continental origin of the Early Carboniferous Horton Group. In other areas, the Windsor Group directly overlies Precambrian or Early Paleozoic basement rocks.

Dolomite deposits are common throughout the Windsor Group though dolomitic limestone may be a more accurate term.

Windsor Group carbonate deposits are generally much smaller than the George River Group deposits. They are usually bedded, containing varying amounts of impurities throughout, or fossiliferous in the form of shell mounds which are extremely pure but not extensive. Numerous geological disturbances since deposition of the limestone beds has resulted in considerable faulting and folding causing the majority of limestone beds to be steeply dipping. For the most part, Windsor Group limestones are less crystalline and more porous than the older, more altered George River Group.

USES-OLD AND NEW

The traditional uses of limestone in the Province have been fulfilled by Nova Scotia deposits for many years. These include processed stone (for pulp mills, glass plants, smelter flux), pulverized stone (aglime, dusting for coal mines, asphalt filler) and crushed stone (cement manufacture, quick and hydrated lime). Limestone consumption has in recent years levelled off due to changes in processing technologies of some industries. New technology has decreased demand in some traditional markets, but it has also opened doors for limestone consumption in new markets.

Potential areas of growth for limestone consumption are in environmental clean-up programs. Perhaps the foremost of these in Nova Scotia is flue gas desulphurization in coal fired power generating plants. Many different processes are presently under study, but regardless of the technology used, they all require large amounts of limestone. Since the Nova Scotia Power Corporation is committed to using Provincial resources of coal for power generation, then local limestone resources have a very large and attractive market.

The reclamation of fresh water resources damaged by acid rain represents another future market for limestone. This is especially true in southwestern Nova Scotia where there is virtually no natural buffering from the shallow granitic soil.

Waste management has employed lime for years as a disinfectant, deodorizer and fungicide and more recently as a flatulent to increase dewatering efficiency in sewage treatment plants. Such lime treated sludges are sometimes used as soil conditioners. Lime still commands a share of the water treatment market due to its low cost and it being environmentally preferred to alternate systems.

Another area where high grade Nova Scotia limestone has very good market potential is in the filler and extender industry. There are numerous quality restrictions for limestone entering this market including a high brightness reading, high calcium values, and low magnesium and silica contents. In the paint, plastic and paper processing industries, limestone serves to reduce the consumption of more expensive raw materials.

Zones in some of the George River Group deposits appear to meet the requirements of the filler industry. Samples from a limestone deposit at Glencoe, Inverness County give brightness readings of 94 per cent, $CaCO_3$ values of > 96 per cent and combined SiO_2 and MgO content of < 2 per cent. A market is available in the Atlantic region for stone of this grade in the paint and carpet backing industries and, as well, there is potential in the paper industry of the Northeastern United States.

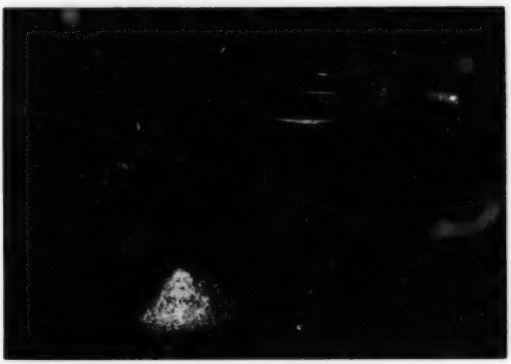


Plate 2. Filler grade Glencoe limestone.

PRESENT DAY OPERATIONS

There are several operations presently quarrying limestone and dolomite in Nova Scotia. Quarries at Irish Cove and Kelly Cove on Cape Breton Island are supplying the demands of the steel plant at Sydney. A large limestone quarry at Brookfield, Colchester County supplies the nearby Lafarge Canada Inc. cement plant. Pulp mills within Nova Scotia are supplied with lime from local limestone deposits. Aglime for the Provincial and regional market is supplied from local deposits by Mosher Limestone Company Limited operating in Upper Musquodoboit, Halifax County.

LIMESTONE OCCURRENCES WITH HIGH POTENTIAL FOR DEVELOPMENT

As previously noted, there are many documented occurrences of limestone and dolomite throughout Nova Scotia (Shea and Murray, 1967; Murray, 1975). Of all the Windsor Group carbonate deposits, only a few have the reserves available for special uses other than local aglime applications. Deposits of the Windsor Group with known reserves greater than 1 million tonnes are few, the exceptions being the Glen Morrison, Gabarus Lake, and Irish Cove areas of Cape Breton County, the North Ingonish area of Victoria County, the South Side Harbour area of Antigonish County and the Brookfield area

Table 1. Provincial reserves available for special uses.

Applications	Estimated Reserves Available	
1. Metallurgical stone	470	million t potential
2. Fluidized bed combustion	470	million t potential as above but depends on sulphation capacity
3. Cement manufacture	725	million t
4. Aggregate	725 +	million t
5. Fillers and extenders	13	million t
6. Agriculture lime	50 +	million t
7. Mine rock dust	22 +	million t
8. Dimension stone	10	million t

of Colchester County. There are also areas in Hants County which may have viable deposits. The best deposits for development are the large tonnage, varied grade George River Group carbonates found on Cape Breton Island. Table 1 indicates the reserves available for specified applications.

Glencoe, Inverness County

The largest and best quality carbonate deposit with excellent development potential is located at Glencoe, Inverness County where in excess of 345 million t of cement grade limestone, 235 million t of metallurgical grade limestone and 5 million t of dolomite have been proven (MacNeil, 1976). Additional tonnage potential is excellent. The deposit has nearly all grades of carbonate available and is located 13 km from tide water, 50 km from the deep water port at the Strait of Canso, 6.5 km from the Trans-Canada Highway 105 and 9.7 km from

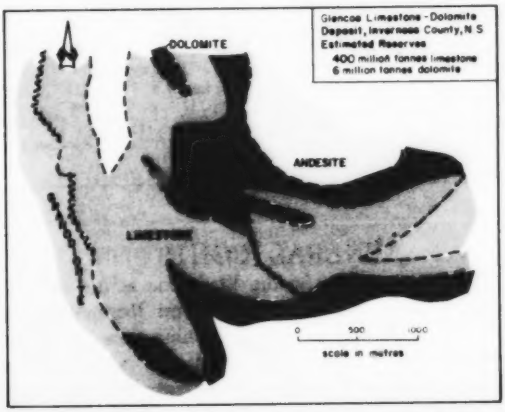


Figure 2. Geology of Glencoe limestone and dolomite deposit.

Marble Mountain, Inverness County

A diamond drilling program was recently completed in the old Marble Mountain quarry which ceased operating in 1922. The drilling delineated a considerable tonnage of high brightness, high purity marble with great potential for use in the filler industry.

Kewstoke, Inverness County

Another high potential, high volume carbonate deposit is located near Glencoe at Kewstoke, Inverness County with proven reserves of 275 million t of cement grade limestone, 72 million t of metallurgical grade and 12 million t of dolomite. Selected deposits are summarized in Table 2. Additional tonnages are possible at these locations and at other unexplored areas nearby.

Table 2. Estimated reserves of other selected Nova Scotia limestone deposits.

Location	Estimated Limestone Reserves		Dolomite
	Cement grade	Metallurgical grade	
Glendale, Inverness Co.	77 + million t		large tonnage potential
Kelly Cove, Victoria Co.			3.5 million t
Marble Mountain, Inverness Co.	5 + million t		
Cape Dauphin, Victoria Co.	18 million t	1 million t	
Campbell Brook, Inverness Co.		89 million t	
Churchview, Inverness Co.			4.3 million t

MINERAL RIGHTS

In Nova Scotia, limestone is not considered a mineral under the Mineral Resources Act *except* in certain areas where limestone has been declared to have a higher economic value and has been designated a Crown Mineral. In this case mineral rights may be granted on behalf of the Province of Nova Scotia by the Department of Mines and Energy through an exploration license. Dolomite is a Crown Mineral.

SELECTED BIBLIOGRAPHY

Luke, P. H., in prep.: Fillers and extenders in Nova Scotia; Nova Scotia Department of Mines and Energy.

MacDonald, R. H., 1986: Summary of the major limestone/dolomite deposits of Nova Scotia; Nova Scotia Department of Mines and Energy, Open File Report 86-064.

MacDonald, R. H., in prep.: Reports on various commodities; Nova Scotia Department of Mines and Energy.

MacNeil, D. J., 1976: The Glencoe limestone and dolomite survey; Nova Scotia Department of Mines and Energy, Open File Report 329.

Murray, D. A., 1975: Limestones and dolomites of Nova Scotia; Nova Scotia Department of Mines, Bulletin 2, Part 2.

Shea, F. S. and Murray, D. A., 1967: Limestones and dolomites of Nova Scotia, Cape Breton Island; Nova Scotia Department of Mines, Bulletin 2, Part I.

Webb, T. C., 1986: Limestone in New Brunswick: past, present and future; New Brunswick Department of Natural Resources and Energy.

Department of
Mines and Energy

Honourable Ken Streatch
Minister

John J. Laffin, P. Eng., FEIC
Deputy Minister

Halifax, Nova Scotia
1988

Nova Scotia Department of Mines
and Energy, Information Circular
No. 13

Canada—Nova Scotia
Mineral Development Agreement

For additional information contact:
Nova Scotia Department of Mines
and Energy
1701 Hollis Street
P.O. Box 1087
Halifax, Nova Scotia
B3J 2X1
Telephone: 902-424-4161
Telex: 019-21690
Telecopier: 902-421-1321